

Non Lethal Materiel Program

Presented by
Hildi S. Libby
Systems Manager
AMC Non Lethal Materiel Program

FY 98/99

Service Program List

1. *NL Crowd Dispersal (M203)*
2. *Acoustic Bio-Effects*
3. *MCCM (NL Claymore)*
4. *Stoppers*
 - a. *Ground*
 - b. *Maritime*
5. *Speed Bump (Net)*
6. *Area Denial Technology*
7. *66mm Vehicle Launched Payload*
8. *UAV NL Payloads*
9. *Bounding NL Munition*
10. *Canister Launched Area Denial System (CLADS)*
11. *Foam Applications*
12. *Acoustic Generators*
13. *Vortex Ring Gun*
14. *Underbarrel Tactical Payload Delivery System*

The Goals

FY95

FY00

FY 05

FY10

Short Term

Put a "family" of multi-purpose, easily trained, and inexpensive non-lethal tools which can be employed from existing weapons platforms into the hands of the soldiers in order to satisfy immediate user requirements.

Long Term

Improve on solutions to immediate requirements. Anticipate and provide solutions to future user requirements.



Mission Need Statements

The US Marine Corps and Army have Approved
Mission Need Statements

- Areas of Commonality include:

Enhancing Operational Capability

Conduct Operations across the Range
of Military Operations

Missions include: Cordon and
Search, Humanitarian Assistance,
Peace Enforcement, Peace
Keeping

Systems that provide flexible
means of response

Strategy

FY95

FY00

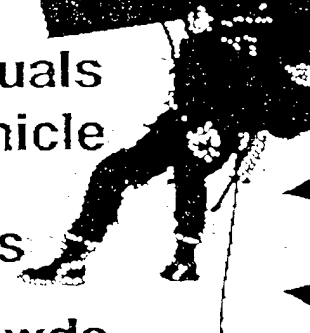
FY 05

FY 10

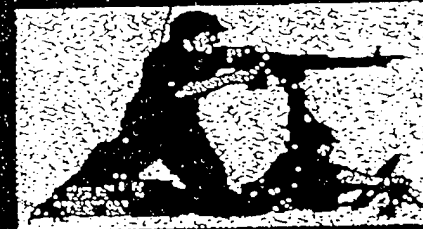
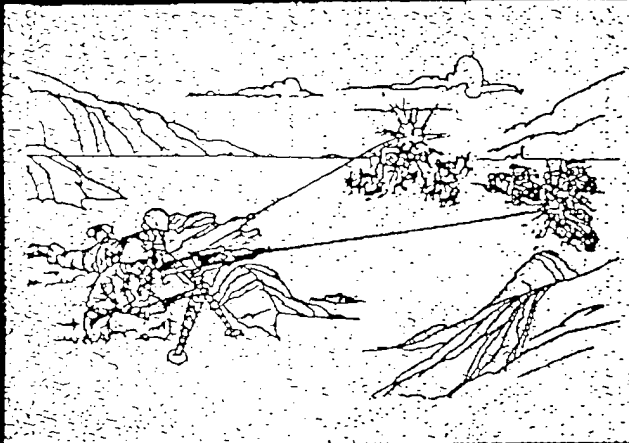
Develop & Advance Technologies
Insert into Existing Weapon Platforms
Develop NL Weapon Platforms
Concept Evaluation Program
ACTDs, BLWEs, JLOEs, AWEs
Transition to PM/PEO

Provide
Capabilities
to:

Incapacitate/Stop Individuals
Distract Individuals Stop a Vehicle
Seize Individuals
Block an Area Control Crowds
Disarm/Neutralize Equipment



Capability/Technology Roadmap



Incapacitate/Stop Individual(s)
Distract Individual(s)
Seize Individuals

Stop a Vehicle
Block an area

Control Crowds

Disarm/Neutralize
Equipment

Acoustics

Kinetics

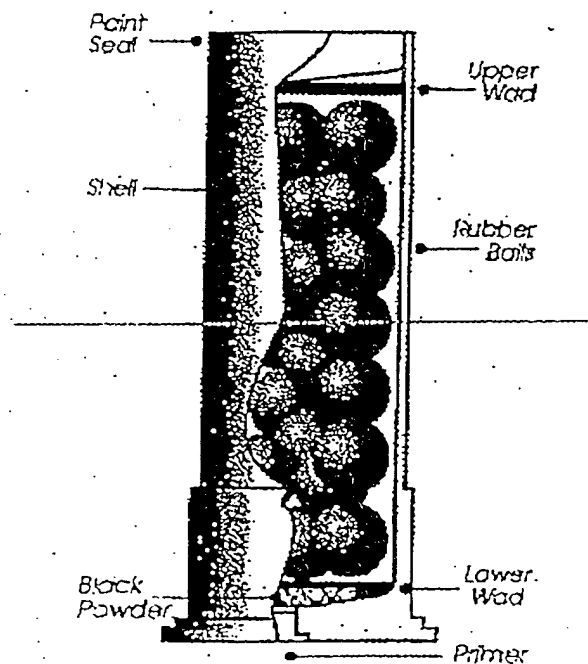
Entanglements

VehicleStoppers

Riot Control Agents

✓	✓			✓	✓
✓	✓				✓
✓		✓	✓	✓	
			✓		✓
✓	✓	✓		✓	✓

NL Crowd Dispersal (M203)



Category: Anti-Personnel

Concept of Operation: Crowd Control Incapacitate Personnel

Technologies: Blunt Impact Trauma

Program Objectives: To Type Classify a 40mm Non-Lethal Crowd Dispersal round for the M203 Grenade Launcher

Acoustic Bio-Effects



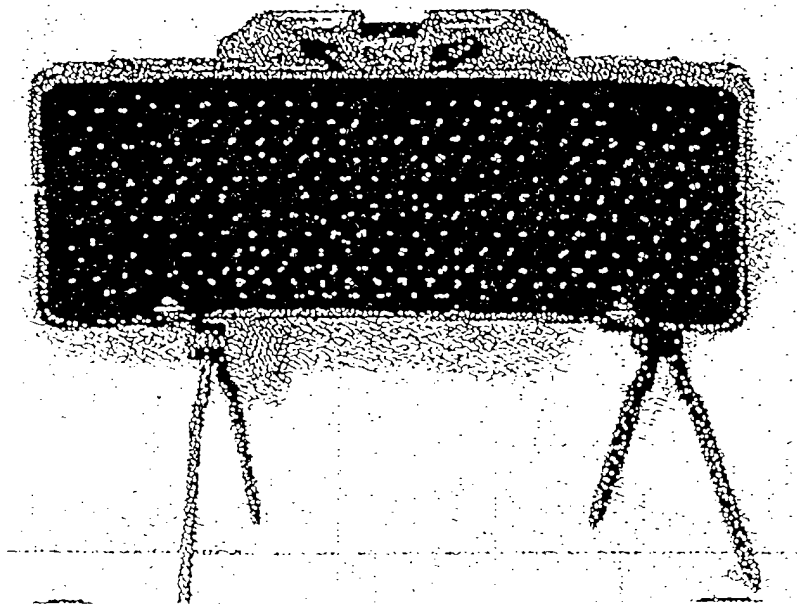
Category: Acoustics

Concept of Operation: Crew-served or vehicle mounted weapon to provide crowd control and/or area denial.

Technologies: Resonance, mechanical pressure wave generation, impedance matching and target coupling

Program Objectives: Provide the warfighter with a weapon capable of delivering incapacitating effects, from non-lethal to lethal.

MCCM (NL Claymore)



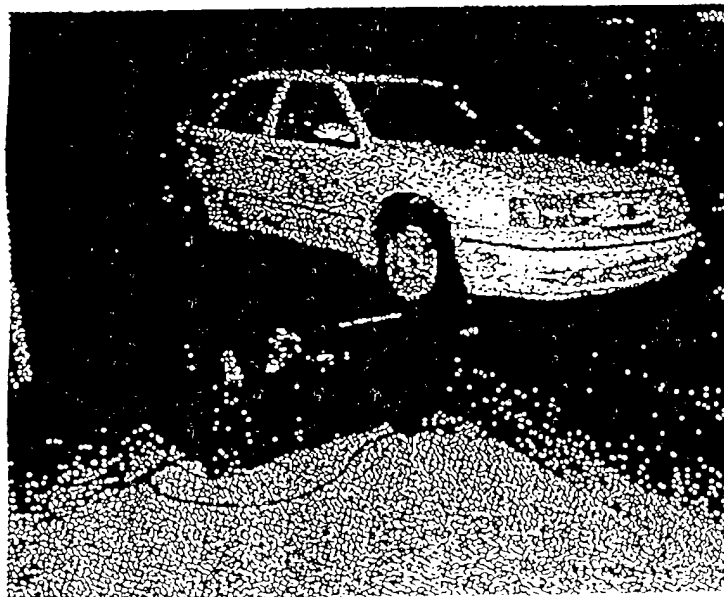
Category: Kinetics, Pre-emplaced.

Concept of Operation: Crowd control
and vehicle self protection
- NL version of M18A1 Claymore

Technologies: Propelling charge with
rubber balls and Flash-bang.

Program Objectives: Transition
design of M18A1 APERS into a device
to produce sting effect at 5-15 meters
with flash and bang.

Stoppers (Ground)

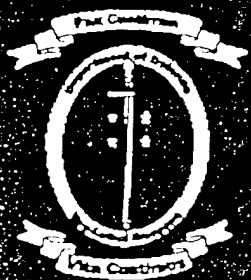


Category: Ground Vehicle Stopper

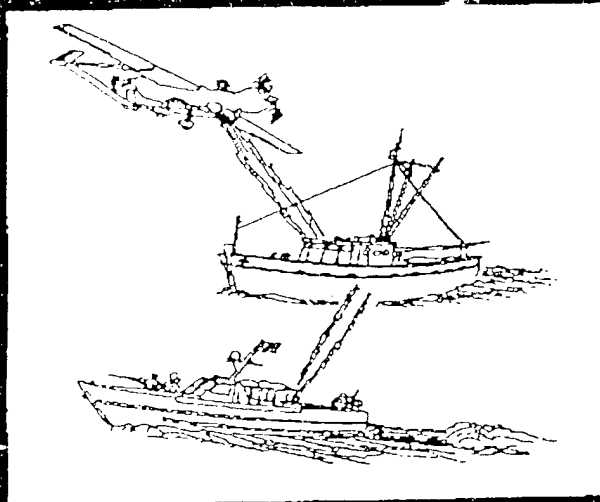
Concept of Operation: Stop a vehicle engine by disabling electronic components

Technologies: Swept frequency microwave transmitter, direct injection device (high voltage)

Program Objectives: Develop a lightweight, compact device capable of stopping both military and commercial engines.

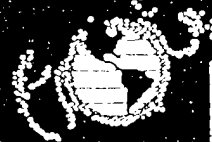


Maritime Vessel Stoppers



- **Objective:** To develop a device that will disable small inboard diesel powered surface vessels without injury to the occupants.
- **Approach:**
 - Target vulnerabilities will be assessed
 - Various anti-material/anti-personnel technologies will be investigated to identify the optimum solution
- **U. S. Navy is the lead investigator**

Director, Joint Non-Lethal Weapons



Speed Bump (Net)



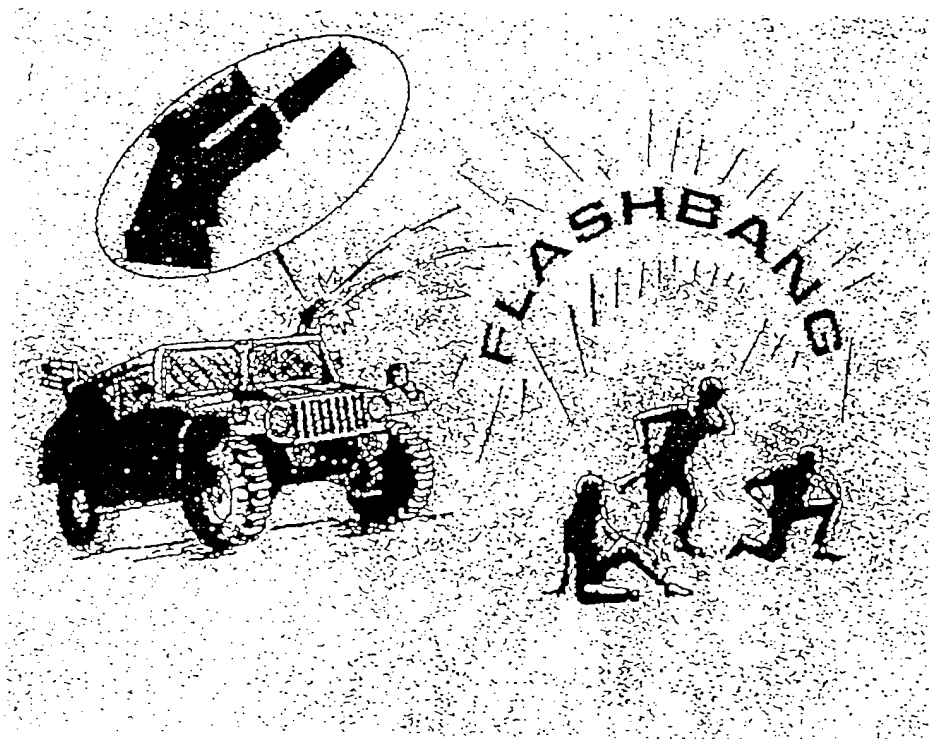
Category: Vehicle Stopper

Concept of Operation: Pre-emplaced at key vehicle entry points without impeding flow of traffic. Command-activated to capture suspect vehicle without serious injury to occupants.

Technologies: Pneumatic telescoping poles, vinyl webbed arresting net, disc braking system.

Program Objectives: To demonstrate a Proof-of-principle pre-emplaced NL vehicle immobilizing "Speedbump" system. The intent is to stop a 5,100 lb vehicle traveling at 40 - 60 mph within 200 ft, without serious injury to the vehicle occupants.

66mm Vehicle Launched Payload

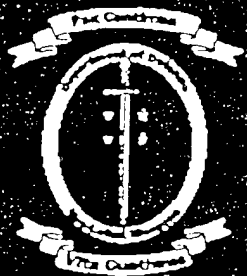


Category: 66mm Vehicle
Launched NL Munition

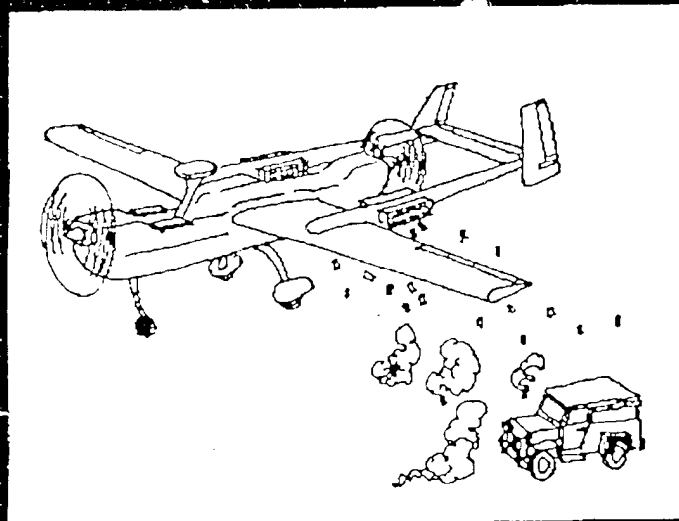
Concept of Operation: System
employed at standoff from
vehicle to deter riotous crowds

Technologies: Kinetics,
Pyrotechnics (Whistles,
flash/bang).

Program Objectives: Develop
NL flashbang payload for 66mm
Vehicle Launched system for
crowd control purposes.

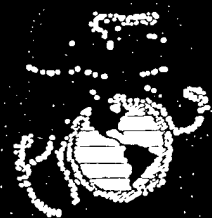


UAV NL Payloads

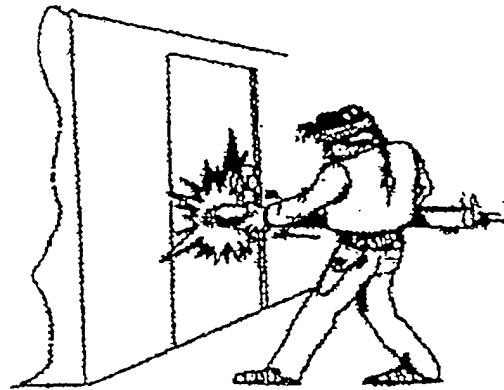
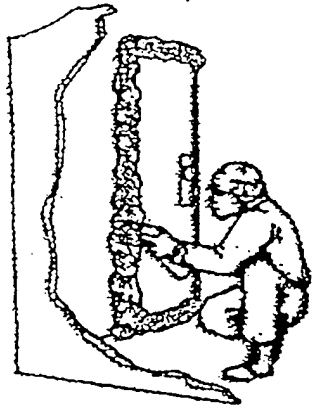


- **Objective:** To develop a non-lethal payload dispensing capability for tactical UAVs
- **Approach:**
 - Develop universal dispenser with UAV specific integration kits
 - Package and demonstrate various non-lethal payloads (e.g. malodorous, stingballs)
- **U. S. Navy is the lead investigator**

Director, Joint Non-Lethal Weapons



Foam Applications



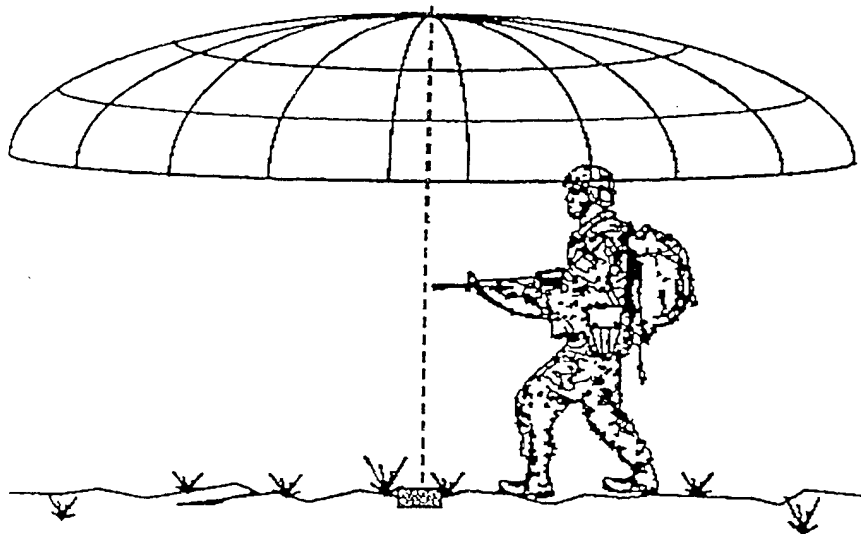
Category: Rigid Foam and Epoxies

Concept of Operation: Rigid foams for area denial and quick seal of doors and window. Also as an anti-materiel agent for small arms and other equipment.

Technologies: Polyurethanes, epoxies, adhesives, dispenser \packaging.

Program Objectives: To formulate/design a fast curing rigid foam and dispensing system

Bounding NL Munition



M139 VOLCANO Dispensed Net
&
M16A2 Hand Emplaced "Bounding Betty"

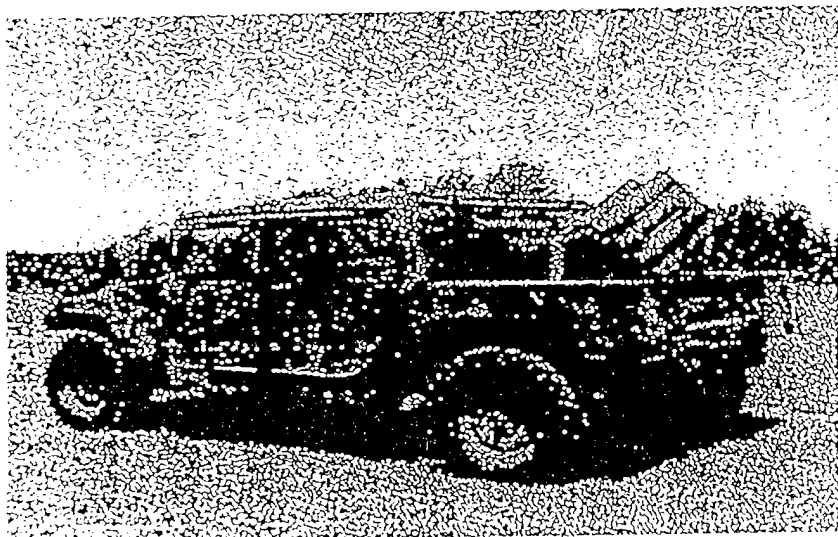
Category: Entanglements, Site Security/
Perimeter Defense.

Concept of Operation: Item functions
similar to tactical bounding APERS mine
(Volcano M16A2) but with entanglement
payload (add delay to APL alternatives).

Technologies: Rapid, reliable
activation (IR sensor, trip wire) for high
reliability capture. Potential
immobilization enhancers - adhesive
(sticky) net and electric (sting) net.

Program Objectives: To demonstrate
the deployment of an entanglement net
from a tactical bounding munition.

Canister Launched Area Denial System (CLADS)



Category: Entanglement (AP/AM)

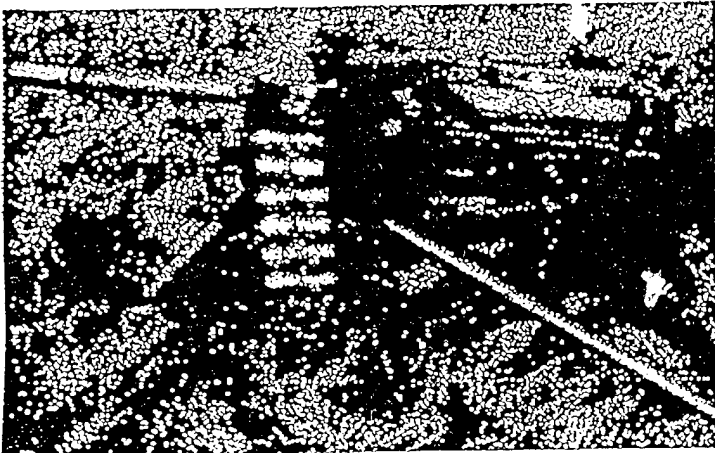
Concept of Operation: Rapidly deploy Non Lethal (NL) payload barriers from the Volcano Mine Dispenser system mounted on a HMMWV, utilizing a 20 canister launcher rack.

Technologies:

- Payload selection (various)
- Modular Payload
- Ignition system to launch payload

Program Objectives: Demonstrate and validate the dispensing of NL payloads (concertina, bounding net, malodorous, etc.) from a Volcano system utilizing a 20 canister rack, mounted on a HMMWV.

Vortex Ring Gun



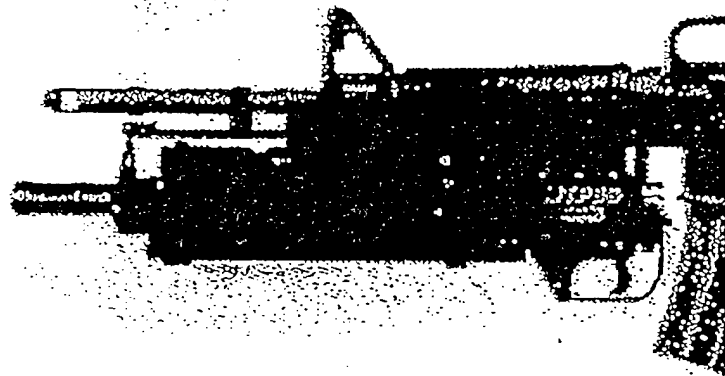
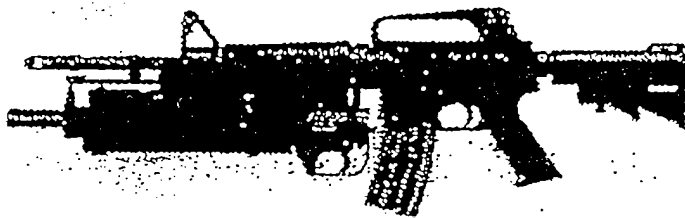
Category: Vortex Ring Gun (VRG)

Concept of Operation: Apply vortex ring gas impulses with flash, concussion, and non lethal agents and/or markers to personnel at approximate human body resonance frequencies to provide the user with area denial and crowd control capability.

Technologies: Vortex ring formation and propagation, entrainment of non lethal and marker agents in vortices, telescoping blank MK-19 40mm round.

Program Objectives: Provide the user with a retrofit kit for the MK19-3 automatic 40 mm grenade launcher to enable quick changes between lethal and non lethal operations employing blank cartridges, a supersonic nozzle and liquid agent reservoir.

Underbarrel Tactical Payload Delivery System



Category: Kinetics - Point and Area Target

Concept of Operation: Neutralize selected targets and areas at a distance of 30-100 meters with a modular, secondary NL multi-shot armament system. Near instantaneous change over to M16A2/M4's lethal fire.

Technologies:

- Pneumatic (compressed-air propulsion)
- Various payloads (impact, OC, dye)

Program Objectives: To integrate an under-barrel non lethal (tactical paint-ball type) weapon system on the M16A2/M4 for Crowd Dispersal, Point Target, and MOUT.

Non-Lethal Materiel Program Conclusions

Specific Requirements
critical to “drive” materiel
development and
acquisition.



User
Requirements



Must be able to control
civilians/noncombatants in
order to succeed on the
missions of tomorrow

The test program was a success, demonstrating that a liquid slug does retain its integrity and that performance is essentially as calculated based on the original theoretical model. Tile and clay targets presented in Figure 2 were shot with the Proof of Principle Liquid Projectile Weapon at ranges between 2 and 12 meters (6.6 to 39.4 feet).

The ballistic pendulum data shows energy delivered to the target decreases monotonically with distance. Using measured slug weight in the pendulum, we solved for terminal velocity. Our calculations showed the slug had lost some mass, but very little velocity. We postulate that as the slug advances through air, its leading edge is peeled off and breaks into droplets which would decelerate greatly before contacting the target or not reach it at all, but the majority remains in a long cylindrical shape, retaining its kinetic energy. A slug weighing 0.33 lb. traveling at 300 ft/sec. carries about the same amount of energy as a 0.45 caliber bullet. This has been shown to have a painful impact.

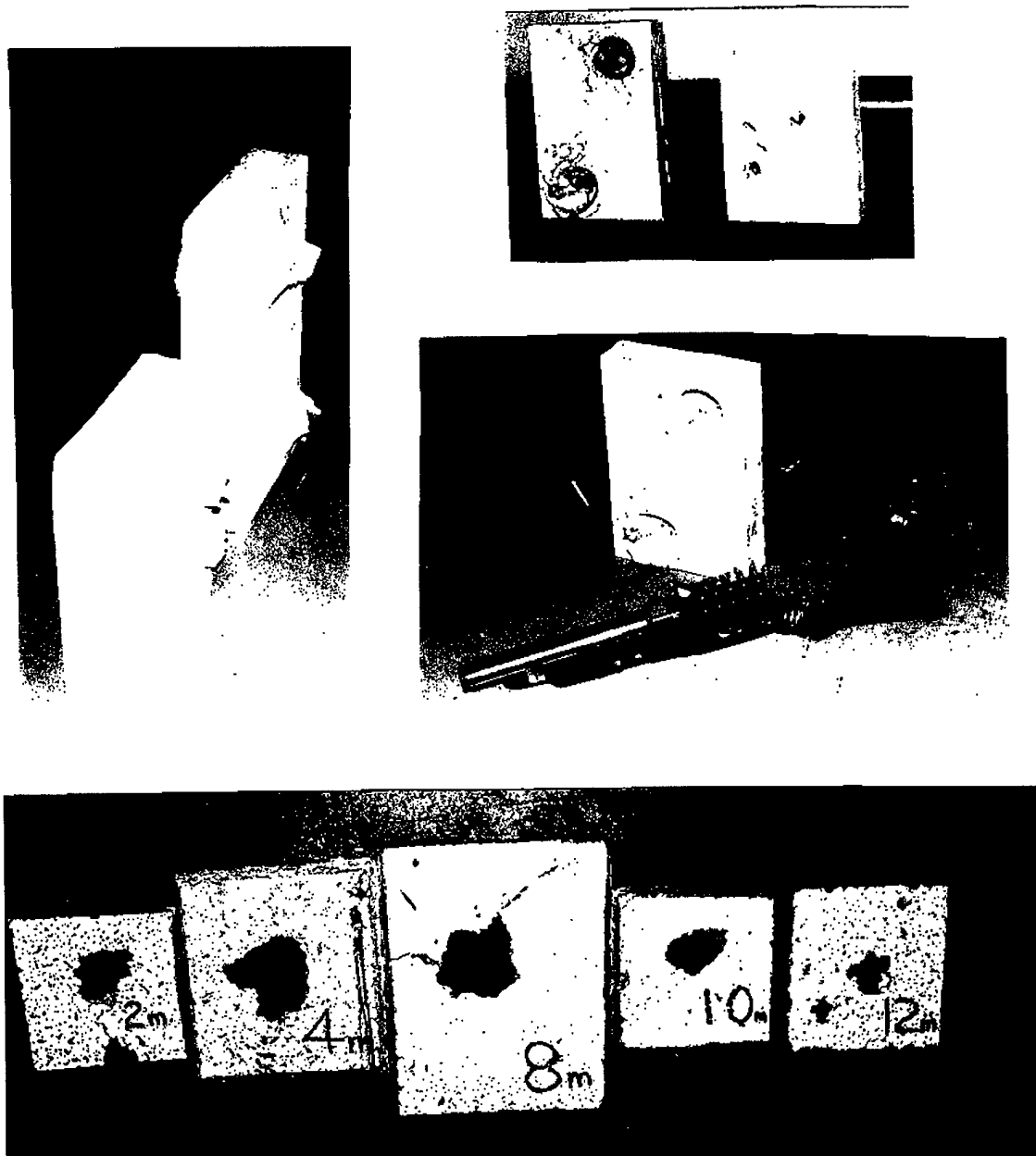


Figure 2. Tile and Clay Targets Shot at Ranged to 40 Feet.

3.0 RESEARCH PROGRAM

UTD has performed engineering, constructed a Proof of Principle mock up, and conducted physical experiments. UTD's IR&D efforts were targeted at answering the fundamental issues of the Liquid Projectile Weapon's feasibility. The key issue was: will the liquid slug transport sufficient energy to a target through a range of at least 40 feet? UTD commenced with a complete theoretical description of significant relationships relating to fluid mechanics including nozzle velocity and discharge rate versus pressure, flow conditions and its effect on the projectile form, range, and velocity.

After conducting engineering analysis, a laboratory test bed was set up. The laboratory apparatus included a proof of principle Liquid Projectile Weapon, shown in Figure 1, consisting of a main cylinder, piston and nozzle, nitrogen gas supply tanks, and valving, capable of launching a slug of liquid at stagnation pressures up to 1000 psi through nozzles ranging in size from 0.375" to 0.75" diameter; a ballistic pendulum capable of measuring the energy and weight of the liquid slug at ranges to 40 feet; and wallboard and clay targets which showed the pattern of the liquid impact.

UTD conducted several hundred test firings to characterize the weapon's performance. UTD used different liquids, internal components, and stagnation pressures. Specific gravity and viscosity had a dramatic effect on how well the liquid slug "held together" after launching. Water, which is better from a clean up standpoint, would atomize at a range of 50 feet or so, and lose its "punch." Water would launch well into the turbulent range ($Re > 10^6$). As expected, maple syrup, which has a viscosity several thousand times greater than water, would launch well into the laminar flow range and held together better at long distances. The specific gravity of maple syrup is 1.3 to 1.5 times fresh water. Surprisingly, we found little difference at ranges under 20 feet.

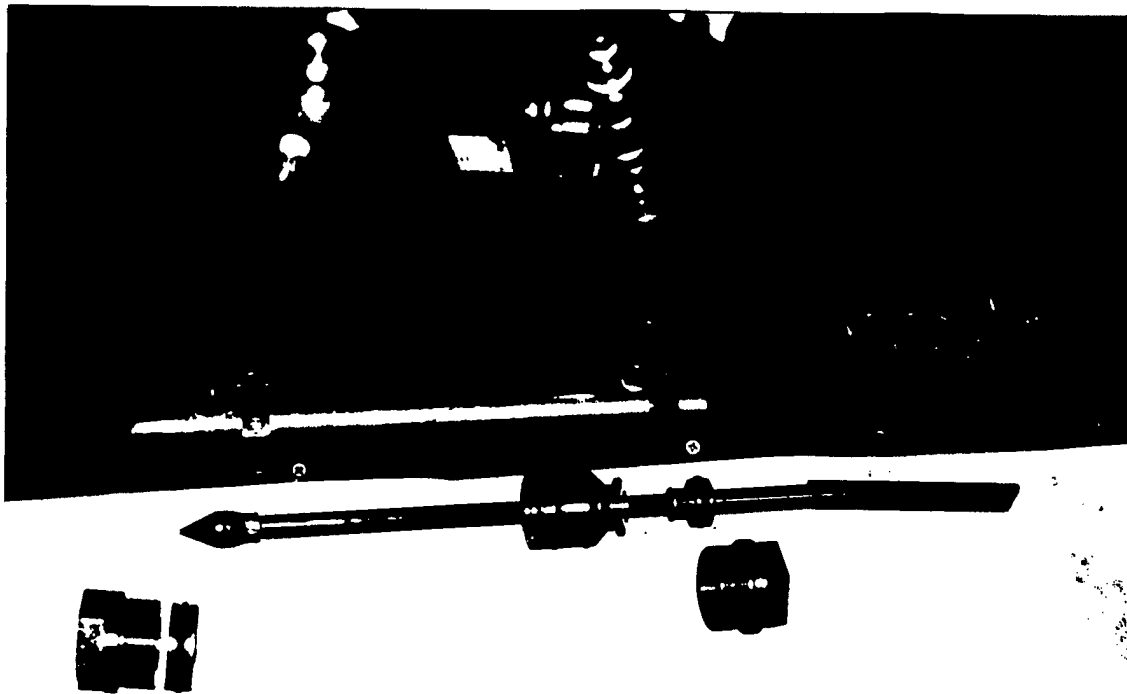


Figure 1. Liquid Projectile Weapon Bench Test Set Up.